BURNS McDONNELL

NECEC Site Location of Development Application

NEW ENGLAND CLEAN ENERGY CONNECT

CENTRAL MAINE POWER

Central Maine Power Company

New England Clean Energy Connect (NECEC) Project
Project No. 99382

9/27/2017

1.0 DEVELOPMENT DESCRIPTION

1.1 Introduction

Central Maine Power Company ("CMP") proposes to construct the New England Clean Energy Connect ("NECEC") Project ("NECEC Project" or the "Project"), a High Voltage Direct Current ("HVDC") transmission line and related facilities capable of delivering up to 1,200 MW of electric generation from the Canadian border to the New England Control Area[1] in response to the Request for Proposals for Long-Term Contracts for Clean Energy Projects dated March 31, 2017 and issued by the Massachusetts Department of Energy Resources and the Electric Distribution Companies of Massachusetts[2] (the "Massachusetts RFP" or "RFP").

The NECEC Project, pursuant to 38 M.R.S. § 487-A(2) and in addition to meeting the requirements of § 484, must also have been approved by the Maine Public Utilities Commission ("MPUC") under Title 35-A, section 3132. CMP expects to petition the MPUC for a Certificate of Public Convenience and Necessity ("CPCN") in October 2017.

The proposed NECEC Project is composed of the following components:

Segments 1, 2, & 3 – HVDC Components and Associated Upgrades

- New 145.3-mile +/-320kV HVDC Transmission Line from the Canadian border to a new converter substation located north of Merrill Road in Lewiston;
- New 1.2-mile 345kV to +/-320kV Transmission Line from the new Merrill Road Converter Station to the existing Larrabee Road Substation;
- Partial rebuild of 0.8 miles of 34.5kV Section 72 AC Transmission Line outside of the Larrabee Road Substation to make room in the corridor for the 1.2 mile 345kV Transmission Line;
- New 345kV to +/-320kV HVDC 1200MW Merrill Road Converter Station;
- Addition of 345kV Transmission Line Terminal at the existing Larrabee Road Substation;

[1] The New England Control Area includes the transmission system administered by ISO-New England, the regional transmission organization ("RTO"), located in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, but does not include the transmission system in northern Maine (i.e., Aroostook County and parts of Penobscot and Washington counties).

[2] Fitchburg Gas & Electric Light Company d/b/a Unitil ("Unitil"), Massachusetts Electric Company and Nantucket Electric Company d/b/a National Grid ("National Grid"), NSTAR Electric Company and Western Massachusetts Electric Company d/b/a Eversource ("Eversource") (collectively, the "Distribution Companies.").

Segment 4 – 345kV STATCOM Substation and 115kV Rebuilds

- New 345kV +/-200MVAR STATCOM Fickett Road Substation;
- New 0.3-mile 345kV AC Transmission Line from the existing Surowiec Substation in Pownal to a new substation on Fickett Road in Pownal;
- Rebuild 16.1 miles of 115kV Section 64 AC Transmission Line from the existing Larrabee Road Substation to the existing Surowiec Substation;
- Rebuild 9.3 miles of 115kV Section 62 AC Transmission Line from the existing Crowley Road Substation in Lewiston to the existing Surowiec Substation;

Segment 5 – New 345kV Transmission Line and Associated Rebuilds

- New 26.5-mile 345kV AC Transmission Line from the existing Coopers Mills Substation in Windsor to the existing Maine Yankee Substation in Wiscasset;
- Partial rebuild of 0.3 mile of 345kV Section 3025 between Larrabee Road Substation and Coopers Mills Substation;
- Partial rebuild of 0.8 mile of 345kV Section 392 between Maine Yankee Substation and Coopers Mills Substation; and,
- Partial rebuild of 0.8 mile each of 115kV Section 60/88 outside of Coopers Mills Substation.

Additional equipment installation and upgrades will be required at Larrabee Road Substation (Lewiston), Crowley's Substation (Lewiston), Surowiec Substation (Pownal), Raven Farm Substation (Cumberland), Coopers Mills Substation (Windsor), and Maine Yankee Substation (Wiscasset), as detailed in Section 1.4.

A Project scope map, dividing the Project into segments for ease of reference, is provided in **Exhibit 1-1**.

1.2 Transmission Lines

The proposed NECEC transmission line components include two basic forms: building new lines and rebuilding existing lines. The Project will include a total of approximately 201.1 miles of new or rebuilt transmission lines constructed within approximately 193 miles of transmission line corridor. Of this, approximately 139.5 miles is existing corridor, and approximately 53.5 miles is new corridor.

New transmission lines will be built in locations where existing transmission line infrastructure does not exist or was determined to be inadequate to meet the needs of the proposed electrical load. The new transmission line equipment includes approximately 145.3 miles of new HVDC line and 28 miles of new

345kV line will be needed. The transmission line components of the project will consist of construction in approximately 28% in new corridor; 49% co-located in existing corridor requiring widening; and 23% of existing corridor with no-widening required.

Rebuilding existing lines may be required for one or more reasons including the need to:
(i) replace structures that are approaching the end of their service life, (ii) increase a line's capacity, (iii) reconfigure to create additional space within an existing corridor, or (iv) limit electrical outages. In some cases, the rebuild will consist of relocating a transmission line section by building a new version of the line at a different location within the same existing corridor. In doing so, adequate space is then created to fit an additional transmission line in the same corridor without the need for corridor expansion. The relocated line may be rebuilt in a different configuration: for example, an H-frame double pole structure may be replaced with a single pole structure. All rebuilds will be operated at the same voltage as the original lines. Rebuilding or reconstruction of existing transmission lines within the same right-of-way is exempt from the Site Location of Development Act ("Site Law") under 38 M.R.S. § 488. Approximately 0.8 miles of 34.5kV and 26.2 miles of 115kV and 1.1 miles of 345kV transmission line will be rebuilt as part of NECEC, all within existing corridors.

The new and rebuilt transmission lines will result in new configurations of lines within the CMP transmission line corridors. Figures depicting the existing and the proposed new configurations within the transmission line corridors can be found in **Attachment 1**, Transmission Line Configuration Cross-Sections.

The transmission line infrastructure improvements described below are also presented in **Table 1-1.**

1.2.1 Section 3006: +/- 320kV High Voltage Direct Current Transmission Line

A new 145.3-mile High Voltage Direct Current transmission line, "Section 3006," located in Segments 1, 2, and 3 of the Project, will be constructed from Beattie Township ("Twp") on the Canadian border to a new converter substation north of Merrill Road in Lewiston. A portion of Section 3006, from Beattie Twp to The Forks Plantation("Plt") (approximately 53.5 miles), will be located within a 150-foot wide cleared right-of-way in a previously undeveloped, 300-foot-wide transmission line corridor. Section 3006 crosses one fragile mountain area (i.e. greater than 2700 feet in elevation), Coburn Mountain, in Johnson Mountain Twp. From The Forks Plt to Wyman Hydropower Station in Moscow, Section 3006 will be located within an existing, partially developed 300-foot-wide transmission line corridor (Section 222, approximately 21.9 miles). From Wyman Hydropower Station in Moscow to a new DC to AC Converter

Substation in Lewiston, Section 3006 will be located within an existing, partially developed 400-foot-wide transmission line corridor (Sections 63, 278 and 200, approximately 71.5 miles).

Section 3006 will rely on a mix of direct embed and self-supporting tubular steel single and double pole structures.

1.2.2 Section 3007: 345kV Transmission Line

A new, approximately 1.2-mile 345kV transmission line, "Section 3007," located in Segment 3 of the Project, within an existing, partially developed 400-foot wide transmission line corridor (Section 200), will be constructed to connect the Merrill Road Converter Station to the existing Larrabee Road Substation. The conductor will be supported primarily by wood frame structures in a two pole H-frame configuration. Based on final detailed design requirements, CMP also may use steel, round wood, and/or laminated wood structures that may be direct embedded or self-supporting on foundations.

1.2.3 Section 72: 34.5kV Transmission Line Rebuild (Exempt from Site Law)

Approximately 0.8 miles of the existing 34.5kV, "Section 72," transmission line, located in Segment 3 of the Project, will be rebuilt just outside of the existing Larrabee Road Substation. This rebuild will provide space in the corridor to allow for the new 345kV Section 3007 line between the Merrill Road Converter Station and Larrabee Road Substation. The conductor will be supported primarily by wood pole structures in a monopole configuration. This work is a rebuild only, and is therefore exempt from Site Law.

1.2.4 Section 3005: 345kV Transmission Line

A new, approximately 0.3-mile 345kV transmission line, "Section 3005," located in Segment 4 of the Project, partially within existing corridor, will be constructed to connect Fickett Road Substation to Surowiec Substation.

1.2.5 Section 62 and Section 64: 115 kV Transmission Line Rebuilds (Exempt from Site Law)

Approximately 16.1 miles of the existing "Section 64" 115kV transmission line, located in Segment 4 of the Project, will be rebuilt between Larrabee Road Substation in Lewiston and Surowiec Substation in Pownal, and approximately 9.3 miles of the existing Section 62 115kV transmission line will be rebuilt between Crowley Road Substation in Lewiston and Surowiec Substation in Pownal. For both Sections, the conductor will be supported primarily by wood framed structures in a single pole configuration. Based on the final detailed design requirements, CMP also may use steel, round wood, and/or laminated wood structures that may be direct embedded or self-supporting on foundations. As part of these rebuilds, the

existing H-frame structures will be replaced with single pole structures to maximize available space within the corridor. This work consists of rebuild only, and is therefore exempt from Site Law.

1.2.6 Section 3027: 345kV Transmission Line

A new, approximately 26.5 mile 345kV transmission line, "Section 3027," located in Segment 5 of the Project, will be constructed within the existing 270-foot-wide transmission line corridor from Coopers Mills Substation in Windsor to Maine Yankee Substation in Wiscasset.

1.2.7 Section 3025: 345kV Transmission Line Rebuild (Exempt from Site Law)

Approximately 0.3 mile of the existing "Section 3025" transmission line, located in Segment 5 of the Project, will be partially rebuilt, just outside of the existing Coopers Mills Substation. This rebuild will clear space in the corridor to allow for the new 345kV Section 3027 line between Maine Yankee Substation and Coopers Mills Substation. The conductor will be supported primary by wood pole structures in a H-frame. This work is a rebuild only, and is therefore exempt from Site Law.

1.2.8 Section 392: 345kV Transmission Line Rebuild (Exempt from Site Law)

Approximately 0.8 mile of the existing "Section 392" transmission line, located in Segment 5 of the Project will be partially rebuilt, just outside of the existing Coopers Mills Substation. This rebuild will clear space in the corridor to allow for the new 345kV Section 3027 line between Maine Yankee Substation and Coopers Mills Substation. The conductor will be supported primary by wood pole structures in a H-frame configuration. This work is a rebuild only, and is therefore exempt from Site Law.

1.2.9 Section 60 and Section 88: 115kV Transmission Line Rebuilds (Exempt from Site Law)

Approximately .8 mile of both the existing "Sections 60" and "Section 88" transmission lines, located in Segment 5 of the Project, will be rebuilt (for a total of approximately 0.6 miles of rebuilt line), just outside of the existing Coopers Mills Substation. This rebuild will clear space in the corridor to allow for the new 345kV Section 3027 line between Maine Yankee Substation and Coopers Mills Substation. The conductor will be supported primary by wood pole structures in a monopole configuration. This work is a rebuild only, and is therefore exempt from Site Law.

Table 1-1: Transmission Line Infrastructure by Segment

Segment	Segment Length (miles)	Corridor Type	Municipality (ies)	CMP Section #	Voltage (kV)	New/ Rebuild	Prior/Current Permit #	Section Length (miles)	Description
1	53.5	New	Beattie Twp, Lowelltown Twp, Skinner Twp, Appleton Twp, T5 R7 BKP WKR, Hobbstown Twp, Bradstreet Twp, Parlin Pond Twp, Johnston Mountain Twp, West Forks Plt, Moxie Gore, The Forks Plt	3006	320kV	New	N/A	53.5	New HVDC Transmission Line within an undeveloped ROW from the Canadian Border in Beattie Twp to an intersect with the existing Section 222 corridor in The Forks Plt
2	21.9	Existing	The Forks Plt, Caratunk, Bald Mtn Twp T2 R3, Moscow	3006	320kV	New	N/A	21.9	New 21.9-mile +/- 320kV HVDC Transmission Line from the intersect with the Section 222 corridor to Wyman Hydro Substation in Moscow

Segment	Segment Length (miles)	Corridor Type	Municipality (ies)	CMP Section #	Voltage (kV)	New/ Rebuild	Prior/Current Permit #	Section Length (miles)	Description
3	71.1	Existing	Concord Twp, Embden, Anson, Starks, Industry, Farmington, New Sharon, Chesterville, Wilton, Jay, Livermore Falls, Leeds, Greene, Lewiston	3006	320kV	New	N/A	69.9	New 69.9-mile +/- 320kV HVDC Transmission Line within an existing corridor from Wyman Hydro Substation in Moscow to the new Merrill Road Converter Substation in Lewiston
				3007	345kV	New	N/A	1.2	New 1.2-mile 345kV Transmission Line from the new Merrill Road Converter Substation to the existing Larrabee Road Substation
				72	34.5kV	Rebuild	N/A	0.8	Rebuild 0.8 mile of 34.5kV Section 72 AC Transmission Line outside of the Larrabee Road Substation to make room in the corridor for the 0.9 mile 345kV Transmission Line

Segment	Segment Length (miles)	Corridor Type	Municipality (ies)	CMP Section #	Voltage (kV)	New/ Rebuild	Prior/Current Permit #	Section Length (miles)	Description
4	16.4	Existing	Lewiston, Auburn, Durham, Pownal	62	115kV	Rebuild	N/A	9.3	Rebuild 9.3-mile 115kV Section 62 AC Transmission Line from the existing Crowley Road Substation in Lewiston to the existing Surowiec Substation
				64	115kV	Rebuild	N/A	16.1	Rebuild 16.1-mile 115kV Section 64 AC Transmission Line from the existing Larrabee Road Substation to the existing Surowiec Substation
				3005	345kV	New	N/A	0.3	New 0.3-mile 345kV AC Transmission Line from the existing Surowiec Substation in Pownal to a new substation on Fickett Road in Pownal

Segment	Segment Length (miles)	Corridor Type	Municipality (ies)	CMP Section #	Voltage (kV)	New/ Rebuild	Prior/Current Permit #	Section Length (miles)	Description
5	26.5	Existing	Windsor, Whitefield, Alna, Wiscasset, Woolwich	3027	345kV	New	N/A	26.5	New 26.5-mile 345kV AC Transmission Line from the existing Coopers Mills Substation in Windsor to the existing Maine Yankee Substation in Wiscasset
				3025	345kV	Rebuild	MPRP # L-24620 A through E	0.3	Partial rebuild of 0.3 mile of 345kV Section 3025 near Coopers Mills Substation
				392	345kV	Rebuild	N/A	0.8	Partial rebuild of 0.8 mile of 345kV Section 392 near Coopers Mills Substation
				60/88	115kV	Rebuild	N/A	0.8	Rebuild 0.8 mile each of 115kV Section 60/88 outside of Coopers Mills Substation

N/A- Not applicable, no prior permit.

1.3 Substations

Substations are a necessary component of all electric transmission systems. Substations function as bulk power distribution centers with equipment and transmission lines interconnected, designed and configured to serve as the backbone of the electrical grid. Substations also contain the protective equipment required to ensure the transmission of electrical energy is safe and reliable. The substations of the NECEC are a combination of DC to AC conversion equipment; dynamic voltage support and reactive compensation equipment ("STATCOM"[3]); and switching and voltage step-down equipment arranged to interconnect the various transmission lines and reduce transmission voltage from 345kV to 115kV and/or from 115kV to 34.5kV.

The NECEC Project will involve eight substations, including the development of an AC to DC converter substation and new STATCOM substation. Six substations will have equipment upgrades and installations which will not require yard expansion. The new facilities have been chosen to meet the identified electrical need while minimizing environmental impacts through site selection and equipment configuration.

The specific substation infrastructure improvements contained in the Site Law are presented in **Table 1-2**.

1.3.1 New Substation Facilities

1.3.1.1 Merrill Road Converter Station: 345kV to +/- 320kV HVDC 1200MW

A new DC to AC converter substation is proposed north of Merrill Road in Lewiston, approximately 1.2 miles north of Larrabee Road Substation. The converter substation will occupy approximately 7 acres on a site directly adjacent to an existing transmission line corridor.

1.3.1.2 Fickett Road Substation: 345kV +/-200 MVAR STATCOM

The proposed Fickett Road Substation will be located directly across Allen Road from the existing Surowiec Substation will occupy approximately 6.12 acres adjacent to Fickett Road in Pownal. Substation construction will include the installation of a 345kV +/-200MVAR STATCOM, the installation of three 345kV 100MVAR capacitor banks, and related bus and site work. This new substation will be in a field currently occupied by existing 345kV and 115kV transmission lines.

[3] A static synchronous compensator, also known as a "static synchronous condenser", is a regulating device used on alternating current electricity transmission networks.

1.3.2 Substation Modifications and Upgrades

Modifications are proposed to the existing Coopers Mills Substation in Windsor, Crowley's Substation in Lewiston, Larrabee Road Substation in Lewiston, Maine Yankee Substation in Wiscasset, Surowiec Substation in Pownal, and Raven Farm Substation in Cumberland. None of these modifications, detailed in the sections that follow, necessitate yard expansion.

1.3.2.1 Coopers Mills Substation

Modifications to the Coopers Mills Substation will include 345kV bus work and circuit breaker installations to reposition the existing Larrabee Road Substation and Maine Yankee Substation 345kV transmission lines; the addition of a terminal for the new 345kV transmission line to Maine Yankee Substation; and the addition of a +/-200 MVAR STATCOM.

1.3.2.2 Crowley's Substation

Modifications to the Crowley's Substation will include the replacement of a 115kV switch and bus wire.

1.3.2.3 Larrabee Road Substation

Modifications to the Larrabee Road Substation will include a 345kV line terminal expansion, requiring the addition of a 345kV line termination structure, a 345kV circuit breaker, disconnect switches, instrument transformers, surge arrestors, buswork modifications, support structures, foundations, modifications to the existing protection and control system, and network upgrades. The existing T1 transformer will be replaced with three single-phase autotransformers with a total nameplate rating of 600MVA (from 448MVA) to mitigate thermal overloads under contingency conditions.

1.3.2.4 Maine Yankee Substation

Modifications to the Maine Yankee Substation will include upgrading the existing 345kV bus arrangement to breaker and a half configuration through the addition of a 345kV three-circuit breaker bay, the relocation of the existing Coopers Mills 345kV line, the addition of a terminal for the new 345kV line from Coopers Mills Substation, and the repositioning of the existing 345kV line from Surowiec Substation.

1.3.2.5 Surowiec Substation

Modifications to the Surowiec Substation will include the addition of a terminal for the new 345kV transmission line from the proposed Fickett Road Substation, the addition of a new dead-end A-frame structure, and the addition of a new 345kV circuit breaker.

1.3.2.6 Raven Farm Substation

Modifications to the Raven Farm Substation will include the addition of a 345/115kV 448MVA autotransformer, associated buswork, and termination of the existing 115kV Sections 164, 164A, and 165 transmission lines at the substation.

The specific substation infrastructure improvements are also presented in **Table 1-2.**